

REMARKS

This application contains claims 1-48. Claims 3, 5, 19, 21, 35 and 37 have been canceled without prejudice. Claims 1, 4, 17, 20, 33 and 36 are hereby amended. No new matter has been introduced. Reconsideration is respectfully requested.

Claims 1-48 were rejected under 35 U.S.C. 103(a) over Black (U.S. Patent 6,978,324) in view of Willis et al. (U.S. Patent 5,550,998) and further in view of Bakke et al. (U.S. Patent Application Publication 2003/0023808). Applicant has amended independent claims 1, 17 and 33 in order clarify the distinction of the present invention over the cited art. The amended independent claims incorporate features of the invention that were formerly recited in claims 3, 5, 19, 21, 35 and 37 (now canceled), as well as in claim 11. Dependent claims 4, 20 and 36 have been amended for proper dependence in view of the cancellation of the intermediate claims from which they formerly depended.

In support of the patentability of the amended claims over the cited art, Applicant submits herewith a Declaration under 37 C.F.R. 1.132 by Dr. Michael Factor, who is an expert in the field of data storage systems. As explained in detail in the Declaration, a person of ordinary skill in the art of data storage systems would not have been motivated to combine the cited references. Dr. Factor points out, furthermore, that even combining the teachings of the cited references would still not have enabled the person of ordinary skill to arrive at the claimed invention.

Claim 1, as amended, recites a method for managing a data storage system that uses a record of locations to which the host processor is expected to write data in managing data backup to a secondary storage subsystem. These expected write locations are indicated by a

predetermined prediction algorithm based on the locations to which the data have already been written. This record is then used in determining which data to copy back from the secondary to the primary storage subsystem during failure recovery. This sort of predictive record keeping is described in detail in the present patent application with reference to Figs. 2-4. The advantages of using this method in failure recovery are explained in the specification in paragraphs 0010-0011 and are described in detail in paragraphs 0043-0044.

Black describes a method and apparatus for controlling read and write accesses to a logical entity. For this purpose, host computers use an "enterprise logical volume identifier," or "ELVID." In rejecting the claims in the present Official Action, the Examiner evidently identified the "record" recited in the claims with Black's host table 181. The host computer uses the host table "to identify an ELVID with a particular physical address identifier specified in the data access request by the host" (col. 27, lines 47-50). In other words, the host uses the table in order to determine the physical location of an ELVID that the host has specified for purposes of data access (col. 25, lines 45-50). If this mapping is not known for a given ELVID, the host looks up the mapping and then adds an entry to the table (col. 25, lines 51-63).

As pointed out in the Declaration, Black describes a function that is carried out by the host computer, outside the storage system. Black makes no suggestion that the host (or any other entity) might, in addition to the entries that it adds to the host table, add further locations to the table that have not been specified by the host, as required by claim 1. In fact, since Black's host itself maintains the table, it is logically impossible for the host to "add further locations to the table that have not been specified by the host."

Furthermore, although Black describes a system that includes primary and secondary storage elements (Figs. 10 and 11), he neither teaches nor suggests the sort of record-keeping and failure recovery functions that are recited in amended claim 1. The host table mentioned above is maintained for entirely different reasons, having nothing to do with these storage elements and functions.

Bakke describes a method for maintaining data coherency in a dual I/O adapter, wherein each of the primary and secondary adapters includes resident write cache data and directory storage devices (abstract). In rejecting the claims in this application, the Examiner cited Bakke as disclosing storage of data on non-volatile storage media. Bakke, however, neither teaches nor suggests maintaining a record of locations to which data are expected to be written by a host processor, or updating the record by adding locations that have not yet been specified by the host processor, as required by claim 1.

Furthermore, as pointed out in the Declaration, Bakke's I/O adapters are outside and separate from any data storage system. The process of synchronization that Bakke describes between his adapters and their respective caches (paragraph 0044) simply involves flushing and disabling the caches of the adapters entirely. There is no conveying of data from one adapter to the other upon recovery. Thus, there cannot possibly be any motivation to use a predictive record (or any kind of record) in Bakke's system for conveying data between subsystems under these circumstances.

Willis describes a pre-seeking process for enhancing reading and writing performance in a mass storage system. As explained in the Declaration, Willis uses the term "storage system" to refer to a very different type of entity from the data storage system that is recited in

claim 1: Willis defines a "mass storage system" as a group of individual disk drives, such as a RAID system, that may be used in place of a "single disk mass storage system" (abstract; col. 1, lines 19-27). Willis is concerned with the inner workings of the disk drives in an array, and specifically with pre-seeking or pre-locating the transducer of the disk in order to reduce the amount of time necessary to seek the transducer to the appropriate track for a desired read or write operation (col. 6, lines 40-45).

As pointed out in the Declaration, persons of ordinary skill in the art relevant to claim 1 would not have looked to Willis's method of manipulating a transducer in order to learn how to keep a record for the purpose of data mirroring and recovery following failure of a primary storage subsystem. The problem addressed by the invention of claim 1 is of an entirely different nature from that addressed by Willis. There is no suggestion in Willis, Black, or Bakke, or elsewhere in the background art that would have led a person of ordinary skill to apply a technique of transducer manipulation in order to keep a predictive record for purposes of failure recovery.

Therefore, Applicant respectfully submits that claim 1, as amended, is patentable over the cited art. In view of the patentability of claim 1, dependent claims 2, 4 and 6-16 are also believed to be patentable.

Claims 17, 18, 20, 22-34, 36 and 38-48 recite apparatus and computer software products that operate on principles similar to the methods of claims 1, 2, 4 and 6-16. Independent claims 17 and 33 have been amended in like manner to claim 1. Therefore, for the reasons explained above, claims 17, 18, 20, 22-34, 36 and 38-48 are believed to be patentable, as well.

Notwithstanding the patentability of the independent claims in this application, the dependent claims are also

believed to recite independently-patentable subject matter. For the sake of brevity, however, Applicant will refrain from arguing the independent patentability of the dependent claims at present.

Applicant has studied the additional references made of record by the Examiner and believes the claims in this application to be patentable over these additional references, as well.

Applicant believes the amendments and remarks presented hereinabove to be fully responsive to all of the grounds of rejection raised by the Examiner. In view of these amendments and remarks, Applicant respectfully submits that all of the claims in the present application are in order for allowance. Notice to this effect is hereby requested.

Please charge any fees associated with this paper to deposit account No. 09-0468.

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